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(56) Documents Cited
GB 2234576 A EP 0662669 A2 EP 0351951 A2
US 5313230 A

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(54) Abstract Title
Cursor control mechanism for three dimensions

(57) A mouse for controlling a cursor in three dimensions includes a housing 2 containing a ball (not shown) for X-axis and Y-axis control, and an independent device for Z-axis control. The device comprises a driving wheel 6 partially projecting out of the housing for turning by hand. The direction and extent of rotation of the driving wheel is detected electro-mechanically by conductive strips and elements 12, 111 and metal spring strips 3-5, or optically by a transparent grid wheel (151, figure 5), a light source (7) eg. a LED, and a photo-sensor (8) eg. a photo transister.

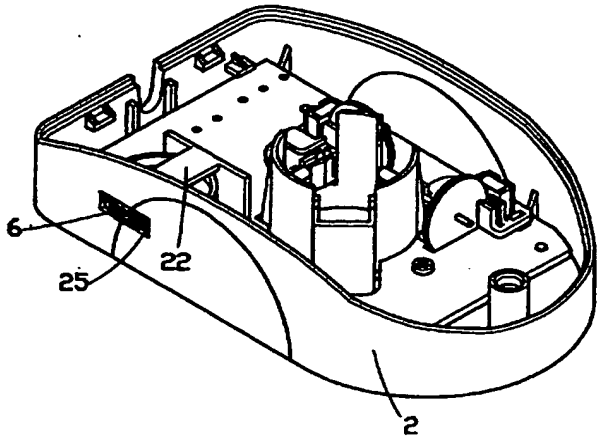

FIG. 1

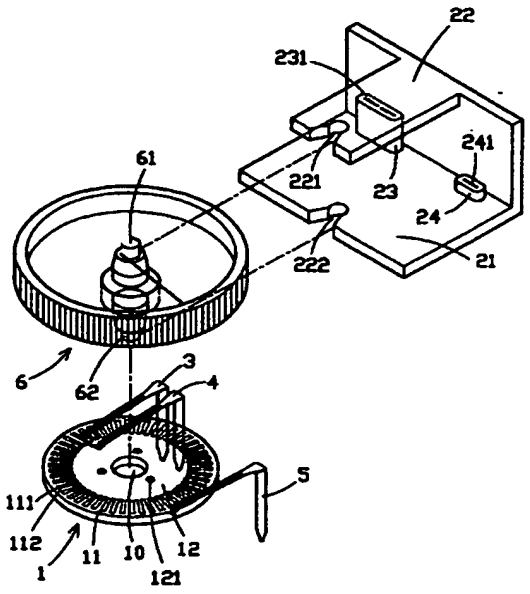

FIG. 3

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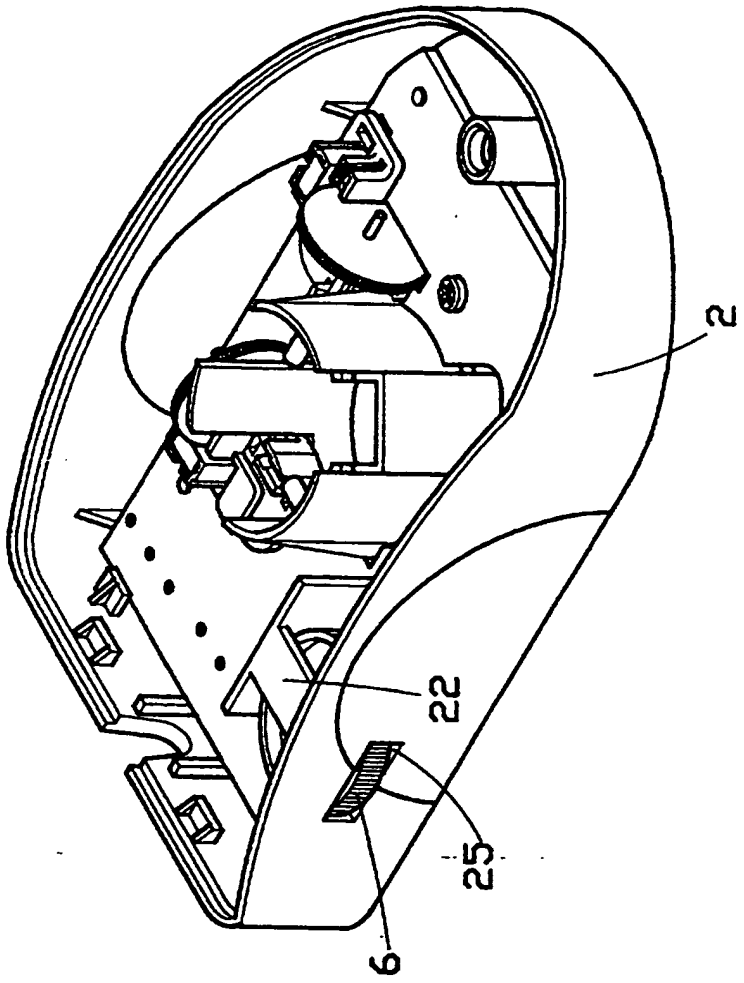

FIG.1

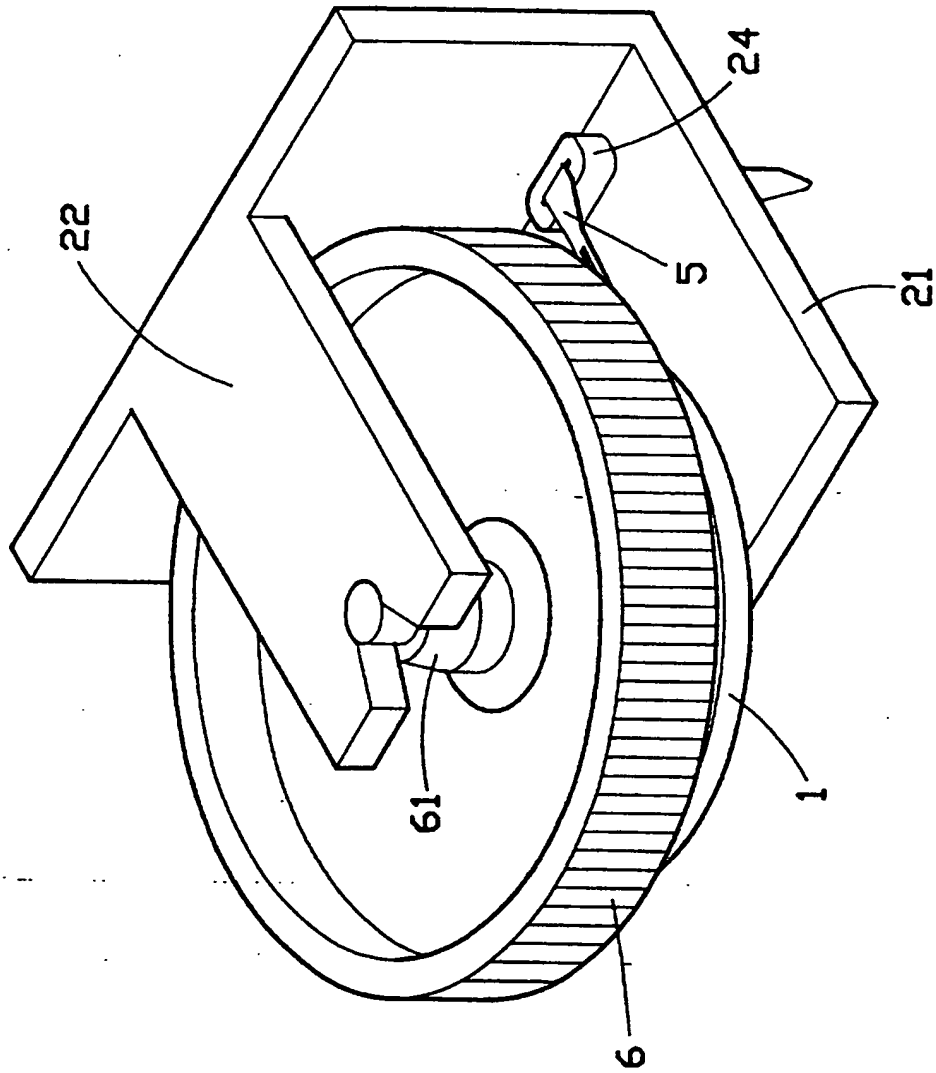

FIG.2

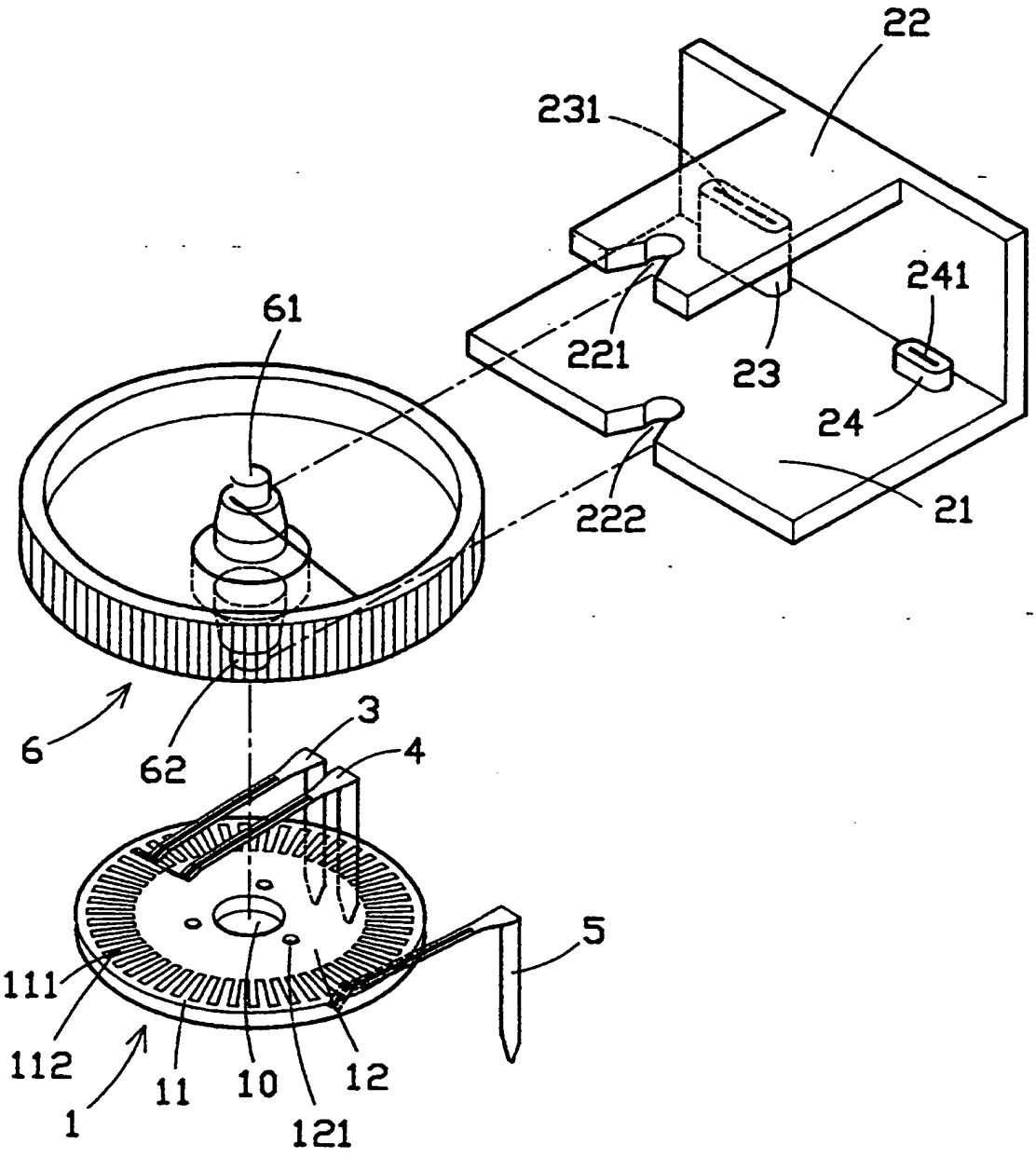

FIG. 3

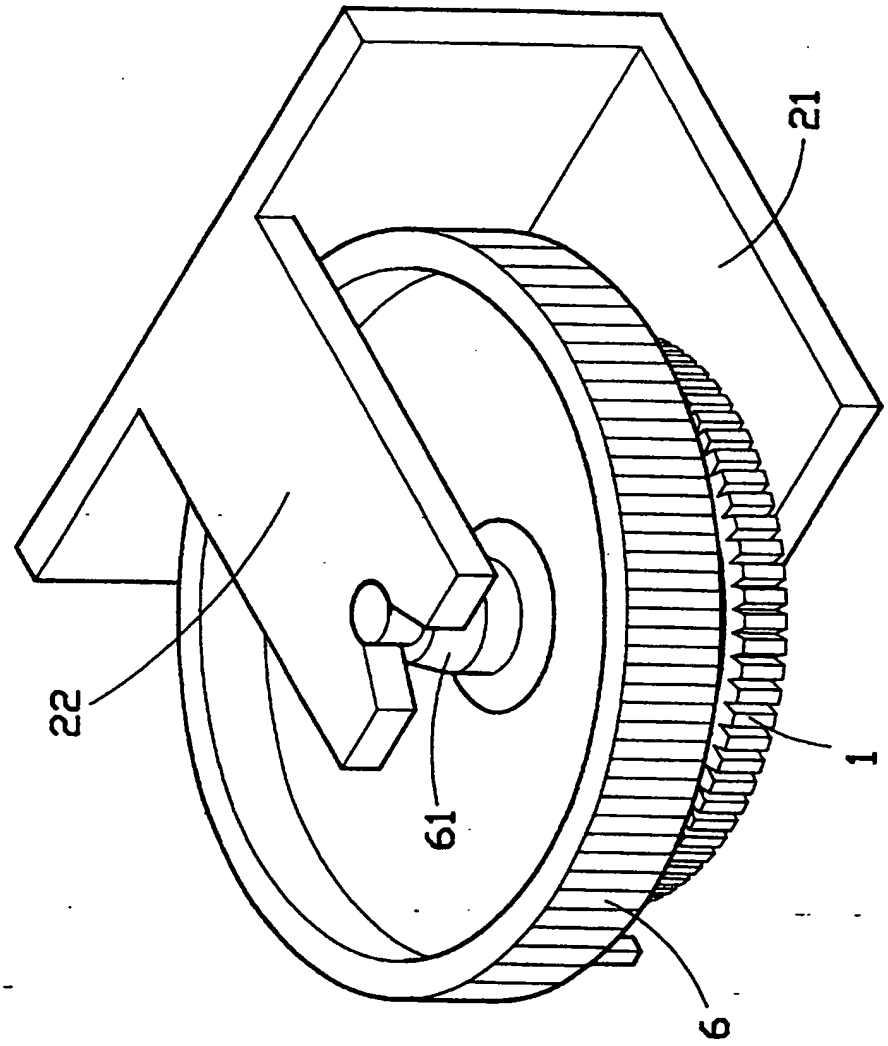

FIG. 4

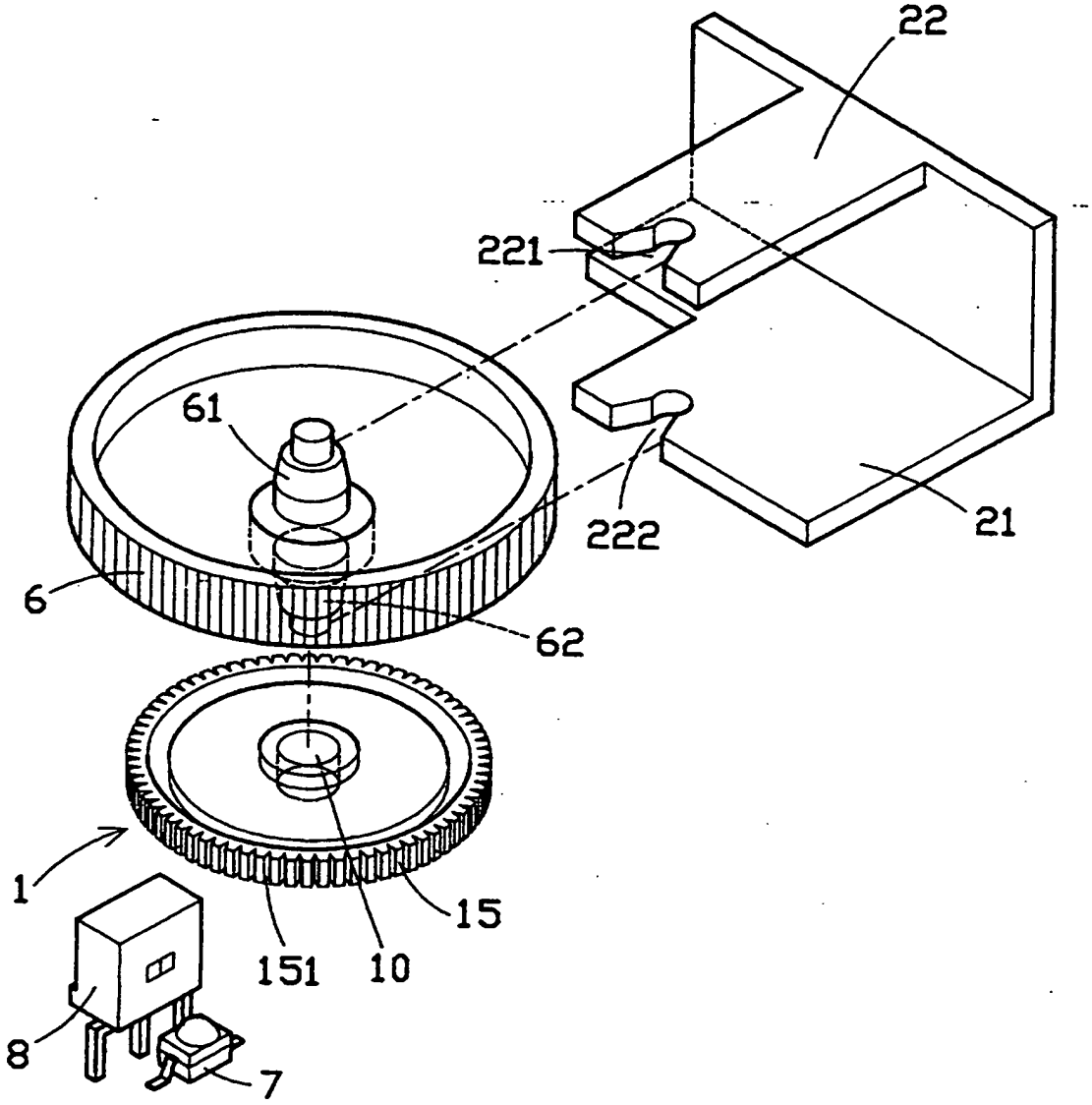

FIG. 5

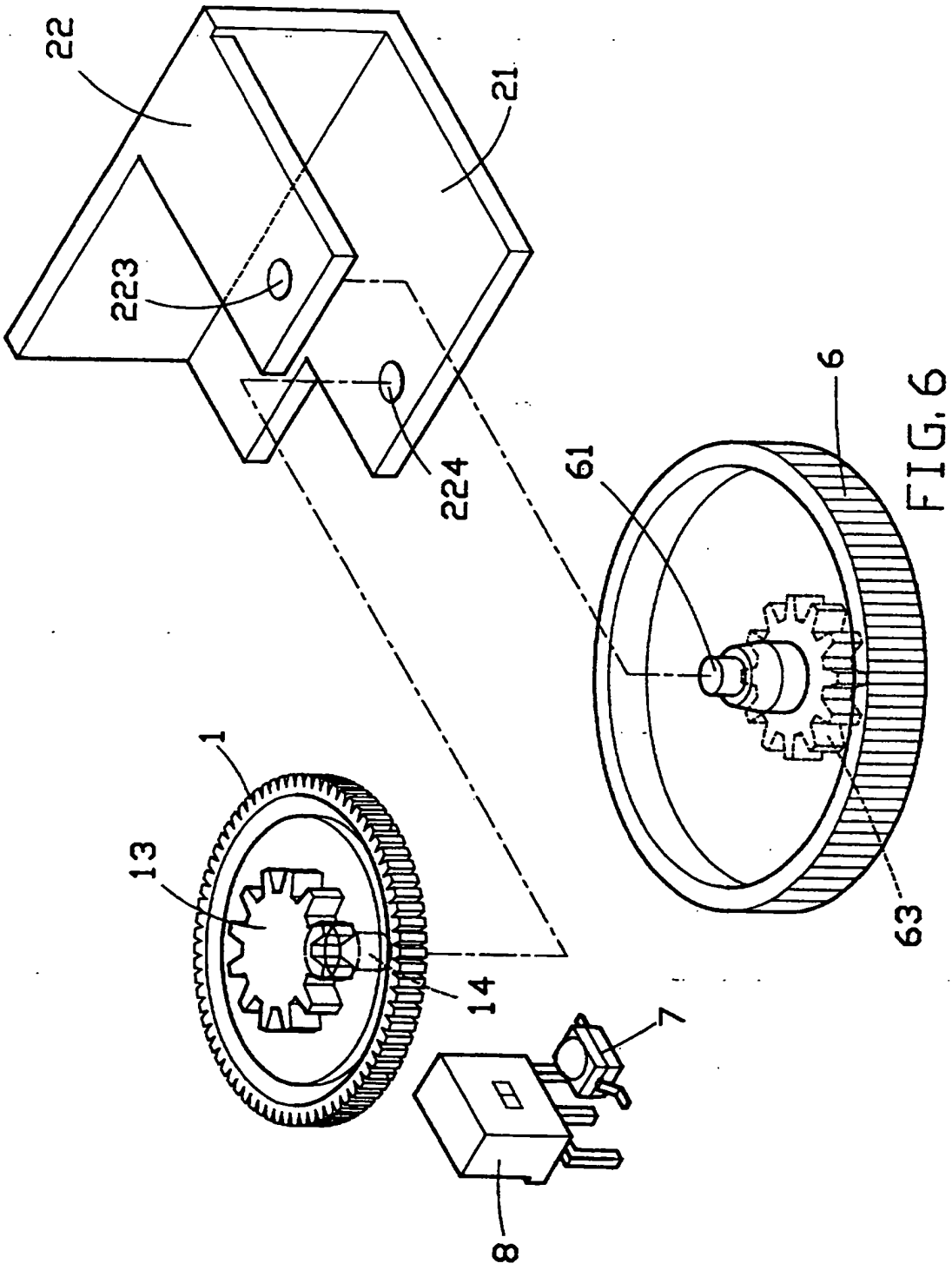

FIG. 6

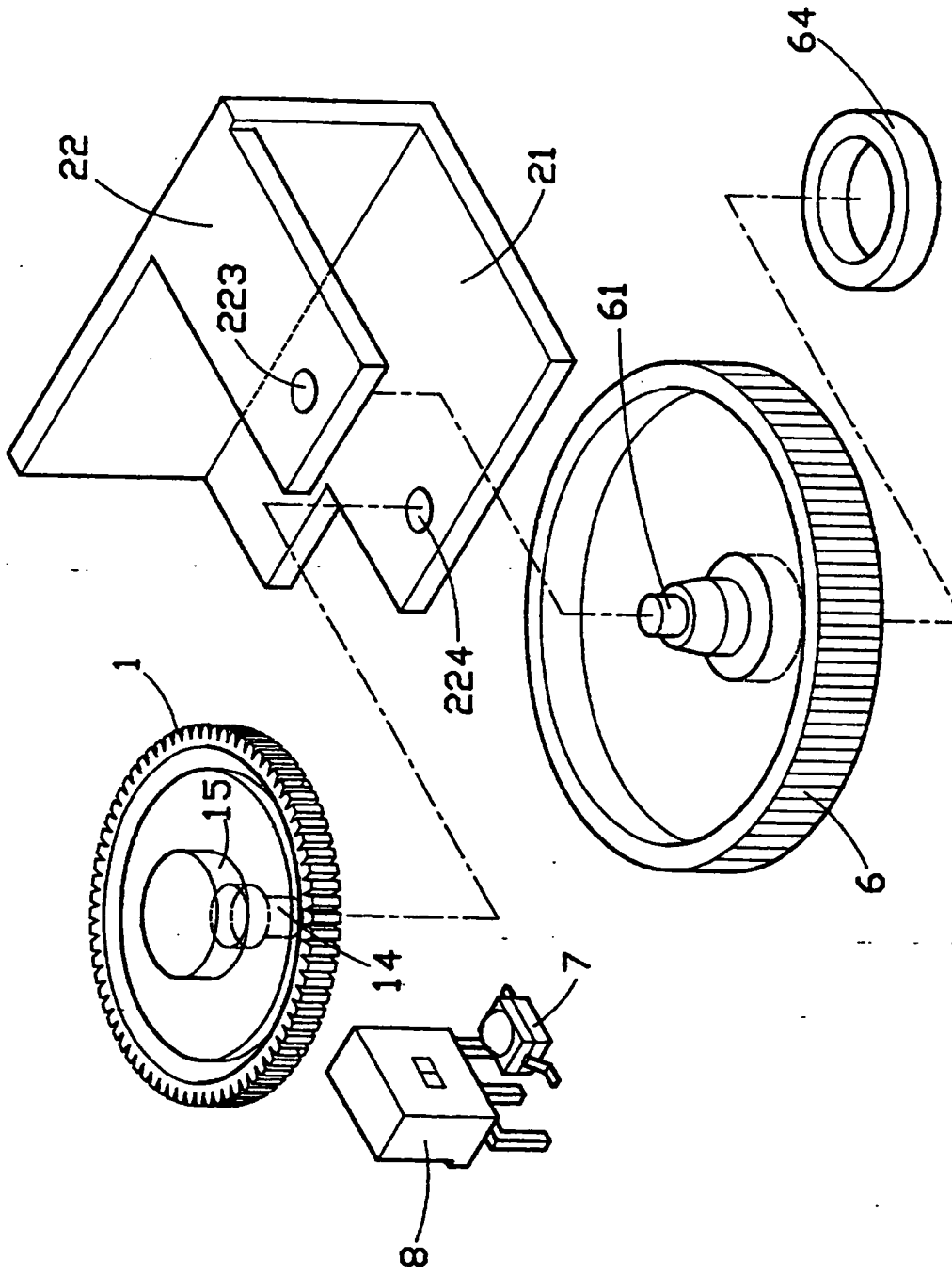

FIG. 7

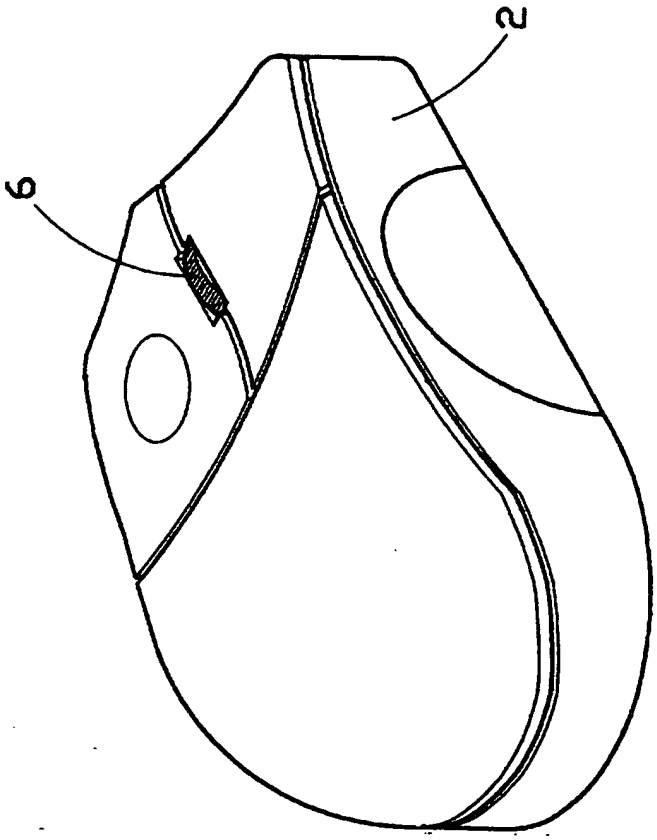

FIG.8

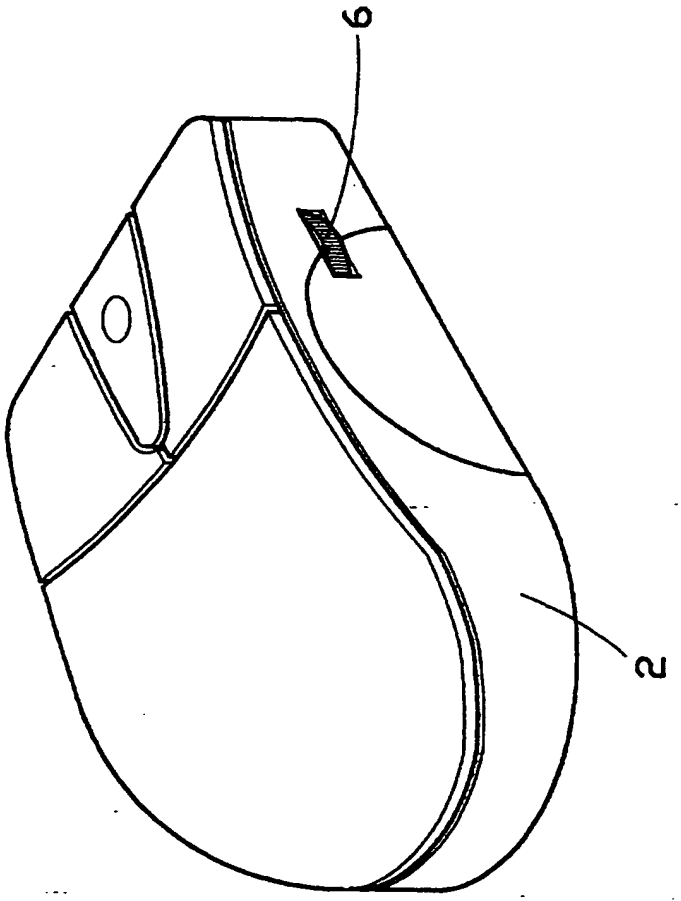

FIG. 9

CURSOR CONTROL MECHANISM FOR THREE DIMENSIONS

BACKGROUND OF THE INVENTION

The present invention relates to cursor control mechanisms, and more particularly to such a cursor control mechanism designed for controlling the amount and direction of movement of a cursor on a display screen in three dimensions. The control mechanism can be made in a mechanical type, or an optical type.

Regular cursor control mice are commonly comprised of a housing holding a track ball. When the track ball is moved on a flat surface, the moving amount and direction of the track ball is detected by a control circuit, and converted into a corresponding output signal for controlling the movement of a cursor on a display screen. However, the control circuit of regular cursor control mice can only detect the movement signal on a plane in X-axis and Y-axis directions, i.e., it cannot detect a movement in Z-axis.

SUMMARY OF THE INVENTION

The present invention has been accomplished under the circumstances in view. It is the major object of the present invention to provide a cursor control mechanism which controls the movement of a cursor on a display screen in Z-axis. According to one embodiment of the present invention, the Z-axis cursor control mechanism comprises a Z-axis driving wheel mounted in a holder

frame inside the housing of a mouse and partially projecting out of the housing for turning by hand, a transparent grid wheel coupled to the Z-axis driving wheel and having a plurality of transverse teeth and a plurality of gaps alternatively spaced around the periphery, a light source for example a light emitting diode controlled to emit light through the transparent grid wheel, and a photo sensor for example a photo transistor adapted for receiving refracted light from the transparent grid wheel and converting it into an output signal corresponding to the moving direction and angle of the Z-axis driving wheel for controlling the amount and direction of movement of a cursor on a display screen.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 shows a Z-axis cursor control mechanism installed in a housing of a mouse according to the present invention;

Fig. 2 is an elevational view of a Z-axis cursor control mechanism according to a first embodiment of the present invention;

Fig. 3 is an exploded view of the first embodiment of the present invention;

Fig. 4 is an elevational view of a Z-axis cursor control mechanism according to a second embodiment of the present invention;

Fig. 5 is an exploded view of the second embodiment of the present invention;

Fig. 6 is an exploded view of a Z-axis cursor control mechanism according to a third embodiment of the present invention;

Fig. 7 is an exploded view of a Z-axis cursor control mechanism according to a fourth embodiment of the present invention;

Fig. 8 is an elevational view of a mouse according to the present invention, showing the Z-axis driving wheel mounted in a vertical position; and

Fig. 9 is an elevational view of a mouse according to the present invention, showing the Z-axis driving wheel mounted in a horizontal position.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to Figures from 1 to 3, a Z-axis cursor control mechanism of a mouse in accordance with one embodiment of the present invention, is generally comprised of a grid wheel 1, a housing 2, a plurality of metal spring strips 3, 4, 5, and a Z-axis driving wheel 6.

The grid wheel 1 comprises a center hole 10, two annular center conductive elements 12 symmetrically disposed at two

opposite sides around the center hole 10, three equiangularly spaced through holes 121 connected between the annular center conductive elements 12, and two grids 11 disposed at two opposite sides around the annular center conductive elements 12. Each grid 11 comprises a plurality of conductive portions 111 and insulative portions 112 alternatively arranged around one annular center conductive element 12. There is an angular difference between the two grids 11. The annular center conductive elements 12 are electrically connected to the conductive portions 111 of the grids 11. The through holes 121 are coated with electrically conductive material to electrically connect the annular center conductive elements 12.

The housing 2 comprises a holder frame 21 having a coupling notch 222, a supporting frame 22 suspended above the holder frame 21 and having a coupling notch 221 in vertical alignment with the coupling notch 222 of the holder frame 21, a first receptacle 23 raised from the holder frame 21 and defining two parallel plug holes 231 adapted for holding the metal spring strips 3, 4, and a second receptacle 24 raised from the holder frame 21 and defining a plug hole 241 adapted for holding the metal spring strip 5. The metal contact spring strips 3, 4 are respectively mounted in the plug holes 231 of the first receptacle

23, and disposed in contact with one grid 11 and one annular center conductive element 12. The metal spring strip 5 has one end plugged into the plug hole 241 of the second receptacle 24, and an opposite end disposed in contact with one grid 11.

The grid wheel 1 and the Z-axis driving wheel 6 are coupled together and mounted in the coupling notches 221, 222 between the holder frame 21 and the supporting frame 22.

The Z-axis driving wheel 6 comprises a first wheel shaft 61 and a second wheel shaft 62 respectively raised from two opposite sides at the center. The first wheel shaft 61 is coupled to the coupling notch 221 of the supporting frame 22. The second wheel shaft 62 is fitted into the center hole 10 of the grid wheel 1 and then coupled to the coupling notch 222 of the holder frame 21. When the Z-axis driving wheel 6 is turned, the grid wheel 1 is synchronously turned with the Z-axis driving wheel 6.

When the Z-axis driving wheel 6 is turned, the grid wheel 1 receives power supply from one or more of the metal strips 3,4,5, the metal spring strips 3, 5 are moved over the conductive portions 111 and insulative portions 112 alternatively and provide a respective output signal of a variable voltage. Therefore, the output signal from the grid wheel 1 controls the amount and direction of movement of the cursor on the display screen.

Figures 4 and 5 show an alternate form of the present invention. A Z-axis cursor control mechanism according to this alternate form, comprises a transparent grid wheel 1, a housing 2, a Z-axis driving wheel 6, a light source 7, and a photo sensor (for example a phototransistor) 8. The housing 2 comprises a holder frame 21 having a coupling notch 222, and a supporting frame 22 suspended above the holder frame 21 and having a coupling notch 221 in vertical alignment with the coupling notch 222 of the holder frame 21. The transparent grid wheel 1 and the Z-axis driving wheel 6 are coupled together and mounted in the coupling notches 221, 222 between the holder frame 21 and the supporting frame 22. The transparent grid wheel 1 comprises a center hole 10, a plurality of transverse teeth 15 and a plurality of gaps 151 alternatively spaced around the periphery. The light source 7 and the photo sensor 8 are respectively disposed adjacent to the transparent grid wheel 1 at different angles. Light from the light source 7 passes through the transparent grid wheel 1, and detected by the photo sensor 8. The photo sensor 8 has an output end connected to an amplifier circuit (not shown). By means of calculating the order and frequency of the output signal from the photo sensor 8, the moving direction and angle of the transparent grid wheel 1 is judged. The Z-axis driving wheel 6 comprises a first wheel shaft

61 and a second wheel shaft 62 respectively raised from two opposite sides at the center. The first wheel shaft 61 is coupled to the coupling notch 221 of the supporting frame 22. The second wheel shaft 62 is fitted into the center hole 10 of the grid wheel 1 and then coupled to the coupling notch 222 of the holder frame 21. When the Z-axis driving wheel 6 is turned, the grid wheel 1 is synchronously turned with the Z-axis driving wheel 6, and light from the light source 7 is refracted by the transparent grid wheel 1 and detected by the photo sensor 8. When the photo sensor 8 is alternatively turned on and off when light from the light source 7 passes through the gaps 151 and the teeth 15, and the variation of light is converted into a corresponding electric signal. Therefore, the photo sensor 8 provides an output signal to control the amount and direction of movement of the cursor on the display screen subject to the moving amount and angle of the Z-axis driving wheel 6.

Figure 6 shows another alternate form of the Z-axis cursor control mechanism. According to this alternate form, the holder frame 21 has an axle hole 224, the supporting frame 22 has an axle hole 223. The axle holes 223, 224 are not vertically aligned. The Z-axis driving wheel 6 has a wheel shaft 61 raised from one side at the center and mounted in the axle hole 223 of the

supporting frame 22, and a gear 63 disposed at an opposite side. The grid wheel 1 has a gear 13 disposed at one side and meshed with the gear 63 of the Z-axis driving wheel 6, and a wheel shaft 14 disposed at an opposite side and mounted in the axle hole 224 of the holder frame 21. When the Z-axis driving wheel 6 is rotated, the grid wheel 1 is turned by the gear 63 of the Z-axis driving wheel 6 to let light of the light source 7 pass and to refract light of the light source 7 alternatively, thereby causing the photo sensor 8 to provide a corresponding signal output for controlling the amount and direction of movement of the cursor on the display screen.

Figure 7 shows still another alternate form of the present invention. According to this alternate form, the holder frame 21 has an axle hole 224, the supporting frame 22 has an axle hole 223. The axle holes 223, 224 are not vertically aligned. The Z-axis driving wheel 6 has a wheel shaft 61 raised from one side at the center and mounted in the axle hole 223 of the supporting frame 22, and a friction wheel 64 disposed at an opposite side. The grid wheel 1 has a friction wheel 15 disposed at one side and peripherally engaged with the friction wheel 64 of the Z-axis driving wheel 6, and a wheel shaft 14 disposed at an opposite side and mounted in the axle hole 224 of the holder frame 21. When the Z-axis driving wheel 6 is rotated, the grid wheel 1 is turned by

the friction wheel 64 of the Z-axis driving wheel 6 to let light of the light source 7 pass and to refract light of the light source 7 alternatively, thereby causing the photo sensor 8 to provide a corresponding signal output for controlling the amount and direction of movement of the cursor on the display screen.

Referring to Figures 8 and 9, the Z-axis driving wheel 6 can be mounted in a vertical position as shown in Figure 8, or a horizontal position as shown in Figure 9.

It is to be understood that the drawings are designed for purposes of illustration only, and are not intended as a definition of the limits and scope of the invention disclosed.

CLAIMS

1 A cursor control mechanism for three dimensions comprising:

tracker ball means for controlling motion of a cursor along perpendicular x and y axes and

independent control means for controlling motion of the cursor along a z axis orthogonal to both said x and y axes.

2. A Z-axis cursor control mechanism, comprising:

a mounting frame structure, said mounting frame structure comprising a holder frame having a coupling notch, a supporting frame suspended above said holder frame and having a coupling notch in vertical alignment with the coupling notch of said holder frame, a first receptacle raised from said holder frame and defining two parallel plug holes, and a second receptacle raised from said holder frame and defining a plug hole;

a Z-axis driving wheel mounted in between said holder frame and said supporting frame, said Z-axis driving wheel comprising a first wheel shaft at one side coupled to the coupling notch of said supporting frame, and a second wheel shaft at an opposite side coupled to the coupling notch of said holder frame;

a grid wheel mounted in between said holder frame and said supporting frame and turned by said Z-axis driving wheel, said

grid wheel comprising a center hole, which receives the second wheel shaft of said Z-axis driving wheel, two annular center conductive elements symmetrically disposed at two opposite sides around said center hole, a plurality of through holes respectively coated with electrically conductive material and connected between said annular center conductive elements, a first and second grid disposed at two opposite sides around said annular center conductive elements, each of said grids comprising a plurality of conductive portions and insulative portions alternatively arranged around one annular center conductive element, said grids being arranged at different angles, said annular center conductive elements being electrically connected to the conductive portions of said grids;

a first metal spring strip having one end mounted in one plug hole of said first receptacle and an opposite end disposed in contact with the first grid of said grid wheel;

a second metal spring strip having one end mounted in one plug hole of said first receptacle and an opposite end disposed in contact with the annular center conductive element of said grid wheel; and

a third metal spring strip having one end mounted in the plug hole of said second receptacle and an opposite end disposed in

contact with the second grid of said grid wheel;

wherein when said Z-axis driving wheel is turned, said grid wheel receives power supply from said metal spring strips, and said first and third metal spring strips are moved over the conductive portions and insulative portions alternatively, thereby causing said grid wheel to provide an output signal corresponding to the moving amount and angle of said Z-axis driving wheel for controlling the amount and direction of movement of a cursor on a display screen.

3. A Z-axis cursor control mechanism comprising:

a mounting frame structure, said mounting frame structure comprising a holder frame having a coupling notch, and a supporting frame suspended above said holder frame and having a coupling notch in vertical alignment with the coupling notch of said holder frame;

a Z-axis driving wheel mounted in between said holder frame and said supporting frame, said Z-axis driving wheel comprising a first wheel shaft at one side coupled to the coupling notch of said supporting frame, and a second wheel shaft at an opposite side coupled to the coupling notch of said holder frame;

a transparent grid wheel mounted in between said holder frame and said supporting frame and coupled below said Z-axis

driving wheel and turned by it, said transparent grid wheel comprising a center hole, which receives the second wheel shaft of said Z--axis driving wheel, a plurality of transverse teeth and a plurality of gaps alternatively spaced around the periphery;

a light source controlled to emit light through said transparent grid wheel; and

a photo sensor adapted for receiving refracted light from said transparent grid wheel and converting it an output signal corresponding to the moving direction and angle of said Z-axis driving wheel for controlling the amount and direction of movement of a cursor on a display screen.

4. A Z-axis cursor control mechanism as claimed in claim 3, wherein said light source is a light emitting diode.

5. A Z-axis cursor control mechanism as claimed in claim 3, wherein said photo sensor is a photo transistor.

6. A Z-axis cursor control mechanism comprising:

a mounting frame structure having a first axle hole and a second axle hole disposed at different elevations;

a Z-axis driving wheel mounted in said mounting frame, said Z-axis driving wheel

comprising a wheel shaft coupled to the first axle hole of said mounting frame structure;

a transparent grid wheel mounted in said mounting frame and turnable by said Z-axis driving wheel, said transparent grid wheel comprising a wheel shaft coupled to the second axle hole of said mounting frame structure, a plurality of transverse teeth and a plurality of gaps alternatively spaced around the periphery;

coupling means coupled between said Z-axis driving wheel said transparent grid wheel for permitting said transparent grid wheel to be synchronously turned with said Z-axis driving wheel;

a light source controlled to emit light through said transparent grid wheel; and

a photo sensor adapted for receiving refracted light from said transparent grid wheel and converting it into a corresponding output signal for controlling the amount and direction of movement of a cursor on a display screen.

7. A Z-axis cursor control mechanism as claimed in claim 6, wherein said coupling means comprises a first gear fixedly mounted on said Z-axis driving wheel at one side, and a second gear fixedly mounted on said transparent grid wheel at one side and meshed with said first gear.

8. A Z-axis cursor control mechanism as claimed in claim 6, wherein said coupling means comprises a first friction wheel fixedly

mounted on said Z-axis driving wheel at one side, and a second friction wheel fixedly mounted on said transparent grid wheel at one side and peripherally engaged with said first friction wheel.

9. A cursor control mechanism substantially as described herein with reference to, and as illustrated in, Fig. 1; or Figs. 1, 2 and 3; or Fig. 1 as modified by Figs. 4 and 5, or as modified by Fig. 6 or as modified by Fig. 7; or Fig. 8; or Fig. 9 of the accompanying drawings.